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A BIOLOGICAL EVALUATION OF IPS BARK BEETLE INFESTATIONS OCCURRING AT MERRITT ISLAND NATIONAL WILDLIFE REFUGE & CANAVERAL NATIONAL SEASHORE, FLORIDA

by

William A. Carothers [1/] & Patrick J. Barry [2/]

1/ Entomologist, USDA Forest Service, Doraville Field Office
2/ Entomologist, USDA Forest Service, Asheville Field Office

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ABSTRACT

An evaluation of Ips bark beetle infestations on Merritt Island National Wildlife Refuge and Canaveral National Seashore showed that all observed infestations were located in areas damaged by wildfires. Ips calligraphus was found in abundance with I. avulsus and I. grandicollis at low levels. Drought conditions are also playing an important part in these infestations.

INTRODUCTION

Merritt Island National Wildlife Refuge and Canaveral National Seashore are located on the east coast of Florida near Titusville (Figure 1). Lands managed by the USDI Fish and Wildlife Service and National Park Service at this location are titled to the National Aeronautics and Space Administration (NASA). NASA began acquiring these lands in the mid 1950's. Through a cooperative agreement the Fish and Wildlife Service began managing a small portion of these lands in 1963. By 1973 the Fish and Wildlife Service was designated to act as the lead agency for wildland management. In 1975, Canaveral National Seashore managed by the National Park Service was established on a portion of this property. Today management by the Fish and Wildlife Service and National Park Service continues on the 140,000 acres titled to NASA.

Of the 140,000 acres, approximately 90,000 acres are terrestrial. Pine habitat is found on 12,000 acres. Three species of pine are found on the refuge: (1) slash pine, Pinus elliottii var. densa, (2) pond pine, Pinus serotina, (3) sand pine, Pinus clausa. Slash pine is the predominant pine species. Pine islands, natural stands, and a few small plantations are present.

During May, June, and July, 1981, 7,500 acres of pine habitat were damaged by wildfires (Figure 1). Many pines damaged in these fires have been attacked by Ips bark beetles. Because of the potential for continuing bark beetle damage, the Fish and Wildlife Service requested the assistance of the USDA Forest Service, Forest Pest Management group. The evaluation was conducted from October 13-15, 1981.

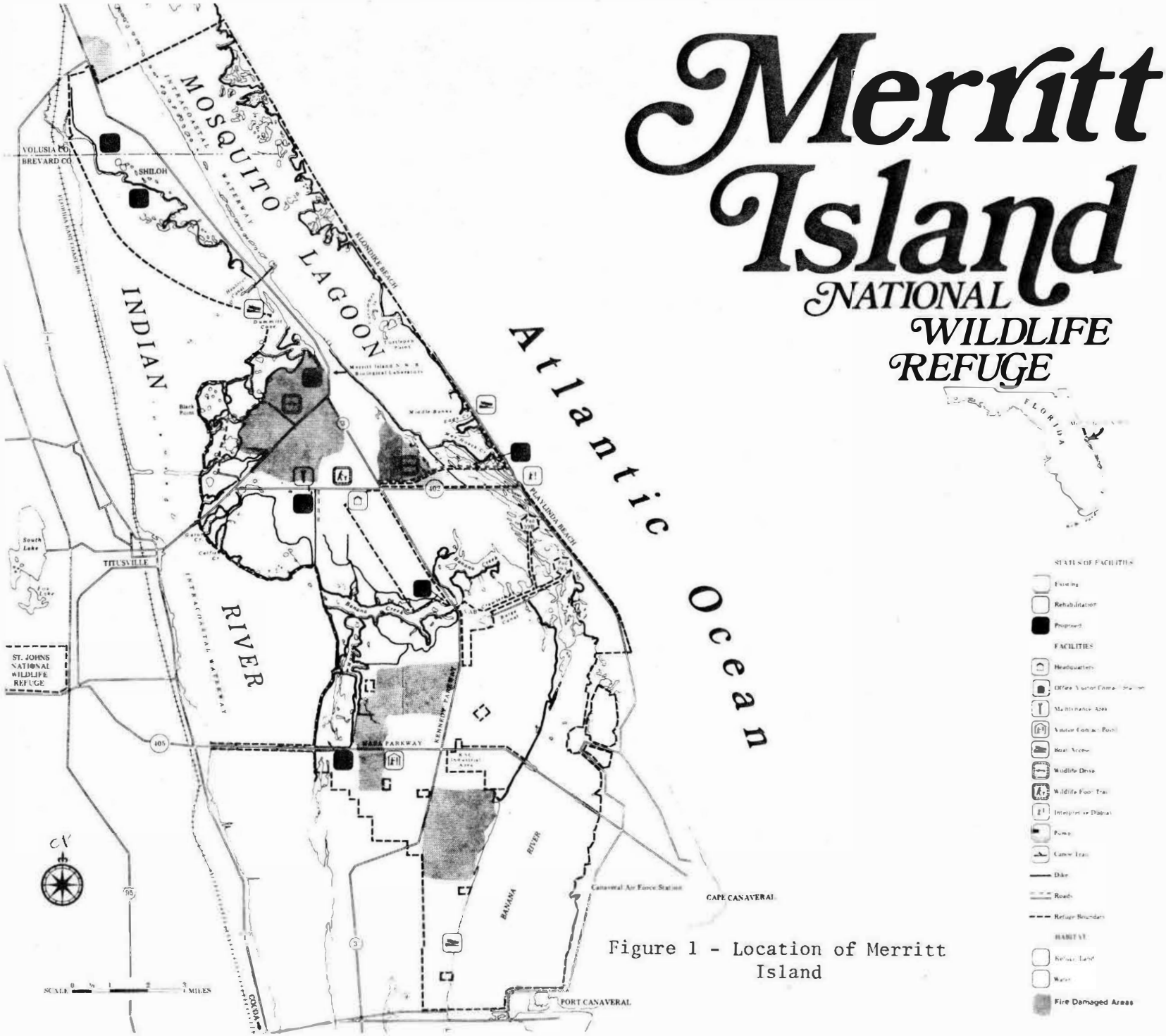

Figure 1 - Location of Merritt Island

BIOLOGY

Ips beetles (or pine engraver beetles) belong to the family Scolytidae. These insects prefer to attack pines weakened by stress factors such as soil compaction, storm damage, drought, and fire. Three common species of Ips occur in the Merritt Island area: Ips avulsus (about 2.5mm in length), Ips grandicollis (about 3.8mm in length), and Ips calligraphus (about 5.0mm in length). Ips beetles prefer to attack material proportionate to their size with I. avulsus usually found in the tops of trees and smaller branches, I. grandicollis in the middle bole, and I. calligraphus nearer the tree base.

Male beetles initiate attacks on the trees. If enough resin is present in the trees, pitch tubes (globs of resin and boring dust) form at the points of attack. Under conditions of low tree moisture, red boring dust may be the only external evidence of attack. Once beneath the bark and in the cambium of the tree, males excavate nuptial chambers (mating chambers) and release a sex attractant. Three to five females normally respond to the attractant of each attacking male. After mating, females construct galleries radiating out from the nuptial chamber where they lay eggs between the bark and the wood. These galleries normally run parallel with the wood grain. Typically, this pattern imparts a "Y" or "H" design on the wood surface and inner bark. Ips beetles also transmit a blue stain fungus, Ceratocystis ips, which helps kill the trees by plugging the conductive tissues. Upon hatching, the wormlike larvae mine outward from the egg gallery and terminate their mines with pupal cells where they transform into adults and emerge directly through the bark (Baker, 1972). This results in the destruction of the cambium layer and the death of the tree. Trees from which Ips beetles have emerged appear as if shot with a scattergun.

There may be 6 to 10 or more generations per year depending on species, season, climate, and amount of rainfall. Under optimum developmental conditions, a generation can be completed in about three weeks.

Normally, Ips beetles pose little threat to healthy timber, but if a large volume of stressed timber is infested, high populations may develop that force successful attacks on adjacent, apparently vigorous trees.

DISCUSSION

As a result of severe wildfires during the spring and summer on some 20,000 acres, many pines have been damaged or killed. In addition to the fires, drought conditions continue to exist throughout Florida. The combination of these stress factors has provided the necessary conditions for build-up of Ips beetle populations. As a result many of the fire damaged trees have been successfully attacked and colonized by these insects. As the population of Ips beetles has increased, trees which suffered minimal or no fire damage have also been attacked and killed. From our observations,

we conclude that infestations will continue until most of the fire damaged timber has been killed. Small numbers of apparently healthy undamaged trees in close proximity to burned pine stands may also be attacked and killed by Ips beetles. Infestations will diminish in intensity as cooler weather occurs, drought conditions cease, and natural parasite and predator populations increase.

RECOMMENDATIONS

Below are listed options for dealing with Ips bark beetle infestations on Merritt Island National Wildlife Refuge and Canaveral National Seashore land under Fish and Wildlife Service management. All are in accordance with U.S. Fish and Wildlife Service management policies.

A. Direct Control Options

1. Pile and burn infested trees

   All trees should be felled toward the center of the infestation. Tree boles, as well as slash and any infested bark, should be piled in a central area away from uninfested pines and burned until the bark is well charred.

2. Solar radiation exposure

   For use when the average daytime temperature is 80^{o} or greater.

   a. Direct exposure method - all infested trees should be felled with the boles in a north-south orientation and spread out for optimum exposure to direct sunlight. The trees should be turned after five days so that all surfaces receive exposure to direct sunlight. This method results in a significant build-up of heat beneath the bark, which destroys developing brood.

   b. Greenhouse effect method - all infested trees should be felled toward the center of the infestation. Trees may be bucked, piled along with the tops, and then covered by heavy gauge clear polyethylene sheeting. The sheeting should be of sufficient gauge to resist tearing and should be securely anchored to the ground. The plastic traps and holds the heat, which kills the developing brood. Polyethylene sheeting should remain intact for 30 days (Buffam, 1968).

3. Debarking

   Trees should be felled and debarked. All bark should be burned to insure destruction of any remaining brood.

4. Removal of Infested Trees by Commercial Sale or Administrative Use

   When infested trees of merchantable size are accessible, they

should be removed by commercial sale or administrative use procedures. Logging of the infested material should begin immediately. Contract time limits should be set to insure rapid removal of infested trees. When only a small volume of infested merchantable material occurs in a spot, non-infested trees surrounding the spot may be marked to provide an operable cut.

The order of priority of removing beetle-infested timber from a spot should be as follows:

--Trees with nearly developed brood (later instar larvae, pupae, callow adults).
--Trees with fresh attacks and having young brood (eggs, young larvae).

5. Chemical Control

The chemical formulation recommended for Ips bark beetle control is a ½ percent lindane spray with water as a carrier. This may be formulated from a 20 percent lindane emulsifiable concentrate at the rate of 11 pints of concentrate in enough water to make 55 gallons of spray. (Ratio of one part 20 percent lindane EC to 39 parts of water).

Dursban (Chlorpyrifos) is also registered for bark beetle control. It is available as a liquid containing 4 pounds of insecticide per gallon of concentrate. The spray is prepared by mixing 2 2/3 fluid ounces of concentrate with water to make 1 gallon or 2.1 gallons of concentrate in 100 gallons of water. Dursban is to be applied only by or under the supervision of a certified pest control operator or other trained personnel responsible for insect control programs.

Cut, limb, and buck all infested trees into workable lengths. Spray the infested bark surface to the point of runoff. A compressed air sprayer (3 gallon capacity or equivalent) is an ideal applicator. Infested logs must be turned two or three times to insure complete treatment of infested bark. Low pressure sprayers may be used to treat large accessible infestations.

The order of priority for cutting and spraying infested trees in a large spot is the same as paragraph (1) under "Removal of Infested Trees by Commercial Sale or Administrative Use". To reduce the possibility of "breakouts" every effort should be made to locate and treat all green trees during the chemical control operation.

Never spray trees from which Ips bark beetle brood have emerged. Spraying prevents natural enemies of these beetles from completing their development.

Instructions for minimizing the adverse effects of mixing, transporting and storing pesticides, applying pesticides, and disposing of pesticide containers and excess chemicals should be obtained from the appropriate source in your agency.

Examination of Treated Areas

Examine areas where infested trees were treated using any of the Direct Control Options stated previously, within 2 or 3 weeks after the treatment to check for additional infested trees. If additional infested trees are found, treat them as quickly as possible.

In any area where infested trees are cut, stumps adjacent to living pine trees should be treated to control or prevent Annosus root rot.

In stands that have been previously thinned or have a history of Annosus root rot, stumps should be treated with the competing fungus Phlebia gigantea.

In stands that have no history of Annosus root rot and have never been thinned, stumps should be treated with borax at the time of cutting.

The stumps of trees infested with Ips beetles cut during the period of May through August, and below 34 N. latitude do not have to be treated with either of the above materials. Few fungal spores are formed during this period and high temperatures often kill spores that are produced. However, routine summer thinnings in areas of Ips bark beetle population buildups are not recommended.

B. Indirect Control Options

In addition to the direct control methods listed above, several preventive measures will help minimize Ips population buildups.

1. Minimize damage to trees and site

Trees under stress are attractive to Ips beetles. When using heavy equipment for road maintenance, building site construction, or general maintenance, use care to avoid physical damage to trees, root damage, and soil compaction.

2. Scatter breeding material during clearing operations

In addition to breeding in stressed trees, Ips beetles reproduce in slash from clearing operations. Scattering the slash promotes rapid dessication of the tops and limbs, making it unsuitable for beetle breeding purposes. Bolts cut from infested or uninfested trees should not be stacked against or near uninfested trees. The resinous odors may attract beetles resulting in the establishment of a new infestation.

3. Do not conduct clearing operations during periods of extreme tree stress

A certain amount of Ips population buildup in slash is almost inevitable. If clearing operations are conducted when trees are stressed (drought, flooding, fire, etc.) residual trees may be attacked and killed as a result.

4. Do not conduct prescribed burning during periods when excessive bark and crown scorch are likely

As evidenced by the current infestations, fire damaged timber is attractive to Ips bark beetles. Controlled burning should be used when it is possible to accomplish the forest management objectives, but also minimize damage to the tree crowns and cambial region. The use of backing and flanking fires as opposed to the hotter burning head fires is recommended. Winter burns when the trees are dormant are also recommended opposed to summer burns when the trees are rapidly growing.

5. Removal of overmature pines

Overmature pines are attractive to Ips bark beetles because of their slow growth and their inability to "pitch out" attacking beetles. The removal through sale of overmature trees is recommended.

C. No Control Option

Under this option, infestations would be allowed to run their natural course until brought under control by parasites, predators, weather, or lack of suitable host material. The disadvantage of this option is that the possibility of additional tree loss exists, before natural control of the infestation occurs. Advantages in utilizing this option are: (1) no cost, and (2) no artificial disruption of the environment.

We suggest that Control Option C be used within the boundaries of the fire areas. Direct Control Options applied in the fire areas would be economically unreasonable and biologically ineffective because of the number of dead and dying trees. Around the periphery or outside of the fire areas, any of the Direct Control Options would be justified in controlling Ips infestations.

In areas where endangered wildlife species' habitats are threatened because of Ips infestations, the use of Direct Control Options is recommended, singly or in combination to preserve the habitat. The use of any of the Direct Control Options is also recommended in other high value areas (scenic and picnic areas, etc.).

Ips bark beetles will continue to exist on Merritt Island National Wildlife Refuge and Canaveral National Seashore as long as pine species are present. While these insects act as natural thinning agents in the ecosystem, any time large numbers of pines are stressed, the Ips populations will build. These insects will remain at endemic levels in lightning struck, overmature, fire damaged, or otherwise stressed trees.

Trees killed by insects, diseases, fire or any other causal agents which pose a threat to visitors, employees or facilities should be considered hazardous and treated appropriately. Field surveillance by Fish and Wildlife Service and National Park Service personnel should continue to promote early detection of potential insect and disease problems. The USDA Forest Service, Forest Pest Management group will conduct an aerial survey to further monitor insect conditions during 1982 at Merritt Island National Wildlife Refuge and Canaveral National Seashore.

ACKNOWLEDGEMENT

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PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key -- out of the reach of children and animals -- and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registration of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure intended use is still registered.

Before using any pesticide, read the label carefully.

LITERATURE CITED

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cc: Steve Vehrs - Merritt Island National Wildlife Refuge
Bill Leenhouts - Merritt Island National Wildlife Refuge
Don Guiton - Canaveral National Seashore
Verlon Carter - U.S. Fish & Wildlife Service, Atlanta
Steve Smith - National Park Service, Atlanta
Area Manager - U.S. Fish & Wildlife Service, Jacksonville, FL
Wayne Dixon - Florida Division of Forestry
Pat Barry - USDA Forest Service, Asheville, NC
Harold Flake - USDA Forest Service, Asheville, NC
Ken Swain - USDA Forest Service, Atlanta, GA
John Bethea - Director, Division of Forestry, Florida